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EFFECT OF DENSITY PRUNING AND APPLICATION OF PACLOBUTRAZOL ON FRUIT YIELD AND FRUIT QUALITY OF MANGO (*MANGIFERA INDICA* L.) CV. KESAR

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ABSTRACT

The study was conducted on an eight-year-old Kesar mango orchard at the Fruit Research Station, Aurangabad (Maharashtra), during the 2023–2024 period. The objective was to evaluate the effects of density pruning and paclobutrazol on the vegetative growth and flowering of Kesar mango. The experiment followed a Factorial Randomized Block Design (FRBD) with two factors, three replications, and nine treatment combinations. Factor A comprised three levels of density pruning i.e P_1: 10% pruning, P_2: 20% pruning and P_3: 30% pruning and factor B comprised of three different level of paclobutrazol dose *i.e.* T_1: 2ml pp^{333}, T_2: 2.5ml $pp^{333}$and T_3: 3ml pp^{333} applied at canopy diameter of tree with three replications. The study found that maximum number of fruits per plant, yield per plant, yield per hectare, non-reducing sugar, total sugar, ascorbic acid and TSS were recorded in 10% pruning. While maximum fruit retention per cent and quality parameters *viz.* fruit weight, fruit breadth, fruit volume, pulp weight, reducing sugar was recorded in 20% pruning. Maximum reducing sugar, non-reducing sugar, total sugar, TSS, fruit retention per cent, number of fruits per plant, yield per plant, yield per hectare were recorded in 3 ml of pp^{333}. Due to increase in number of fruits per plant it reduces fruit weight, pulp weight, fruit length, fruit breadth, fruit diameter and volume of fruit. And among interaction treatment P_1T_3 (10% pruning + 3 ml of pp^{333}) has recorded maximum number of fruits per plant, reducing sugar, non-reducing sugar, total sugar and TSS qualities of fruit.

Key words : Mango cv. Kesar, Paclobutrazol dose and Pruning.

Introduction

Mango (*Mangifera indica* L.), a member of the Anacardiaceae family and it is one of the most favoured fruits due to its delicacy, flavor and nutritional value and it is also known as 'the king of fruits' (Bompard, 2009). The mango fruit is large and varies in shape and size. It has thick yellow flesh, a single seed and a thick yellowish-red skin when ripe. The seed is oval or oblong, enclosed in a hard, fibrous shell (Shah *et al*., 2010).

The mango pulp is composed of a range of macro- and micronutrients. When it comes to macronutrients, mango pulp consists of carbohydrates (16–18%), proteins, amino acids, lipids, organic acids and dietary fiber. It is also a rich source of micronutrients, providing trace elements like calcium, phosphorus, iron as well as vitamins C and A. The consumption of mango pulp offers considerable energy: 60–190 Kcal per 100 g of fresh pulp. In addition to the vital nutritional elements mentioned above, mango pulp contains 75–85% water (Lebaka *et al*., 2021). The essential nutrients found in each part of a mango tree, including its leaves, flowers, bark, fruit, pulp, peel and seeds can be utilized.

The family Anacardiaceae includes the genus Mangifera, to which Mango belongs. Among the 69 species in this genus, only some produce edible fruits. Of all the species, *Mangifera indica* is the only one commercially cultivated. India is home to just three of these species: *Mangifera indica, Mangifera Sylvatica* and *Mangifera coloneura*. (Yadav and Pandey, 2016). The cultivated mango is probably a natural hybrid between

Mangifera indica and *Mangifera sylvatica* that occurred in South-Eastern Asia to India (Yadav and Singh, 2017). India is the leading global producer of mango, accounting for more than 45% of the worldwide fresh mango production, with China and Thailand following closely behind. The average mango yield is 8.39 MT/ha in India, 8.74 MT/ha in China and 8.36 MT/ha in Thailand. Mangoes are highly perishable, making them a delicate commodity. Commercially grown mango varieties in India include Dashehari, Chaunsa, Langra, Safeda and Alphonso. The primary mango-growing states are Uttar Pradesh, Andhra Pradesh, Bihar, Karnataka, Telangana and West Bengal. Uttar Pradesh is the top producer of mangoes, contributing 25.76% of the total production and achieving the highest productivity in 2023-24 (2nd Advance Estimate) APEDA. Additionally, India is a significant exporter of fresh mangoes, having shipped 32,104.09 MT of fresh mangoes globally, valued at Rs. 495.46 crores/ 60.14 USD Millions during the year 2023-24. (Anonymous, 2023-24). In India mango is cultivated in an area of 24.00 lakh hectares producing 217.89 lakh million tonnes having productivity of 9.07 MT/ha as per first advance estimate 2023-24 and as per second estimate 2023-24 of Department of Agriculture, Cooperation and Farmers Welfare, cultivated area for mango in India is 24.06 lakh hectares producing 225.48 lakh million tonnes having productivity of 9.37 MT/ha and in Maharashtra mango is cultivated in an area of 169.30 thousand hectares producing 522.18 thousand million tonnes having productivity of 3.08 MT/ha.

In mango cultivation, pruning involves the deliberate removal of specific branches, shoots, or parts of the tree to enhance its health, optimize fruit production and manage its size and shape. This horticultural practice is vital for maximizing the yield and quality of mango fruits. By selectively removing certain branches and foliage, growers can ensure the efficient distribution of resources within the plant, leading to healthier growth and more abundant, flavourful fruit. The discovery and application of growth-regulating substances, chemicals and similar compounds in horticulture have significantly impacted plant growth behaviour, flower induction, fruit setting, overall yield and mango quality, offering substantial potential for productivity enhancement. Paclobutrazol, a growth retardant, is utilized for regular bearing and fruit development. Paclobutrazol treatment accelerated the physiological maturity of vegetative growth, leading to increased flower bud initiation and the highest flowering, fruiting and yield (Burondkar and Gunjate, 1991).

Materials and Methods

The experiment on Studies on effect of density pruning and application of paclobutrazol on vegetative growth and flowering of Mango (*Mangifera indica* L.) cv. Kesar was carried out at Fruit Research Station in Aurangabad (MH) during the 2023-2024 period on eight-year-old Kesar mango orchard. The experiment was laid out in FRBD (Factorial Randomized Block Design) with two factors, factor A consist of 3 levels of density pruning i.e. P_1: 10% pruning, P_2: 20% pruning and P_3: 30% pruning and factor B consist of different paclobutrazol dose i.e. T_1: 2 ml pp^{333}, T_2: 2.5 ml pp^{333} and T_3: 3 ml pp^{333} applied at canopy diameter of tree with three replications, containing nine treatment combination P_1T_1(10% pruning + 2 ml pp^{333}), P_1T_2(10% pruning + 2.5 ml pp^{333}), P_1T_3(10% pruning + 3 ml pp^{333}), P_2T_1(20% pruning + 2 ml pp^{333}), P_2T_2(20% pruning + 2.5 ml pp^{333}), P_2T_3(20% pruning + 3ml pp^{333}), P_3T_1(30% pruning + 2 ml pp^{333}), P_3T_2(30% pruning + 2.5 ml pp^{333}), P_3T_3(30% pruning + 3 ml pp^{333}). Pruning is done with the help of long reach prunner tool at different densities (10%, 20%, 30% pruning), firstly we have calculated plant canopy volume before pruning and after pruning we have again calculated plant canopy volume accordance to that we have decided pruning density and application of paclobutrazol dose by soil drenching method. The best way to ensure that the paclobutrazol is properly absorbed by the tree is to apply it in to the soil at 15 small holes having 6-inch-deep depth around the fertiliser ring. The solution was made with calculated amount of paclobutrazol (2 ml, 2.5 ml and 3 ml) by dissolving in 1.5 liter of water around 100 ml solution applied in each hole and other cultivation practices were followed as per recommendations and observations of various vegetative growth and flowering parameters were recorded periodically and data was statistically analyzed as per standard methods.

Fruit drop (%)

Four panicle per tree was selected and tagged. The number of fruits drop per panicle was recorded at three stages peanut stage, marble stage and at maturity stage.

The per cent of fruit drop was calculated based on the number of fruits retained per panicle at every stage by using formula

$$\text{Fruit drop}(\%) = \frac{\text{Fruit set} - \text{Fruit retained}}{\text{Fruit set}} \times 100$$

Fruit Retention (%)

Four panicles per each direction of a tree were randomly tagged for counting the fruit set at pea size per

$$\text{Ascorbic acid} = \frac{\text{Titrate} \times \text{Dye factor} \times \text{Volume made up}}{\text{Aliquot taken} \times \text{Volume of sample taken}} \times 100$$

panicles at the time of full bloom. When the fruit set and attained pea stage, marble stage and maturity stage they were counted and average values were calculated for recording fruit set per panicle.

$$\text{Fruit retention}(\%) = \frac{\text{Fruit at maturity stage} - \text{Fruit dropped at harvest stage}}{\text{No. of fruit at marble stage}} \times 100$$

Fruit yield

For yield, the total produce per tree was weighed and recorded in kilograms, then fruit yield per hectare, measured in tons, was determined by multiplying the fruit yield per plant by the number of plants per hectare, then dividing by 1000.

$$\text{Yield in}(t/ha) = \frac{\text{Yield}(kg/plant) \times \text{Number of plants/ha}}{1000}$$

Fruit quality

Physical parameters

Fruit weight (unripe and ripe) (g)

The weight of five unripe and ripe fruits was recorded using the electronic balance for each treatment. The average weight for each treatment in grams was then calculated.

Physiological loss of fruit weight (%)

A fruit from each replication were earmarked for studying physiological loss in weight. The loss in weight was calculated by noting down the difference between initial fruit weight and ripened fruit weight. It was calculated as follows and expressed in percent.

$$\text{PWL } \% = \frac{(\text{Unripe fruit weight - Ripe fruit weight})}{\text{Ripe fruit weight}} \times 100$$

Length and Breadth of fruit (cm)

Ripe fruits from each treatment were harvested and their length and breadth were measured in cm by using a vernier caliper. The average length was then calculated for each treatment.

Diameter of fruit (cm)

The fruits from each treatment were picked and their breadth was measured at maximum girth in cm with the help of thread and then length of thread was measured with the help of scale. The average diameter was then calculated for each treatment.

Volume of fruit (cc)

The fruit volume was measured in ml using the water displacement method, the volume of each fruit in cc was measured. The average volume was calculated and recorded as average volume of fruits.

Peel thickness (mm)

Ripen fruits from each treatment where peel off and thickness of peel was measured in mm by using a vernier caliper. The average peel thickness was then calculated for each treatment.

Peel weight, Weight of pulp and Weight of stone (g)

Ripen fruit from each treatment where peel off with separation of mango pulp and stone then peel weight, weight of pulp and weight of stone were recorded individually with electric balance and then average were calculated.

Pulp: Stone ratio

$$\text{Pulp : Stone ratio} = \frac{\text{Weight of pulp}(g)}{\text{Weight of stone}(g)}$$

Chemical parameters

Reducing sugar (%)

5 mL of each Fehling solutions A and B was taken in a conical flask, followed by the addition of 10 ml of distilled water. The juice was then titrated with boiling Fehling solutions, using methylene blue as an indicator. The endpoint was determined by the appearance of a brick-red colour. The reducing sugar content in 100 g of pulp, expressed as glucose, was calculated according to the method described by Lane and Eynon (1923).

Non reducing sugar (%)

Non reducing sugar (%) = Total sugar (%) – Reducing sugar (%)

Total sugar (%)

10 ml of juice was hydrolysed by adding 3 ml of concentrated HCl and left to react for 24 hours. After hydrolysis, the solution was neutralized with 4 N (NaOH) solution, using litmus paper to monitor the pH. The neutralized solution was then titrated with Fehling solutions A and B following the procedure for reducing sugar and the per cent of total sugar was determined according to Lane and Eynon (1923).

Ascorbic acid (mg/100g)

The ascorbic acid estimation followed the titrimetric method outlined by Ranganna (1986). Ten grams of homogenized pulp were transferred to a 100 ml volumetric flask and filled with a 3 per cent metaphosphoric acid solution. After centrifugation for approximately 10 minutes, the clear supernatant was used for titration. Before the actual titration, 10 ml of the supernatant aliquot was placed in beaker and titrated against standard dye

solution using micro burette. Titration continued until a light pink colour persisted for more than 15 seconds. Ascorbic acid content was calculated using the following formula:

$$\text{Ascorbic acid} = \frac{\text{Titrate} \times \text{Dye factor} \times \text{Volume made up}}{\text{Aliquot taken} \times \text{Volume of sample taken}} \times 100$$

TSS (° Brix)

Total soluble solids were measured using Digital Brix Refractometer with a range of 0-32° Brix. A drop of homogenized pulp was applied to the refractometer and the results were recorded as °Brix.

Statistical procedure

Statistical analysis of the individual data of various characters studied in the experiment carried out as per Factorial Randomized Block Design (FRBD) through computer. Analysis of variance worked out by using standard statistical procedures as described by Panse and Sukhatme (1985). Standard error of mean (S.E m ±) and critical difference (C.D.) at 5 per cent probability were also worked out for the interpretation of the results.

Results and Discussion

Fruit yield

Observation regarding fruit drop, fruit retention, fruit yield i.e number of fruits per plant, fruit yield (kg/plant) and (t/ha) were calculated and represented in Table 1.

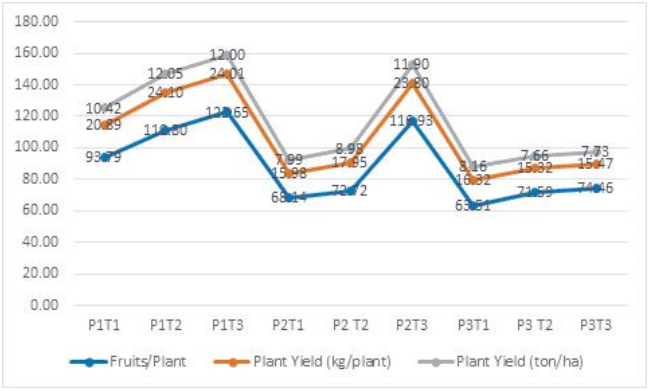
Fruit drop at maturity stage was significantly influenced by density pruning and paclobutrazol dose. Minimum fruit drop was recorded (58.59), (56.69) in P_2 (20% pruning), T_3 (3 ml pp^{333}) respectively and maximum (63.68), (70.30) in P_3 (30% pruning), T_1 (2 ml pp^{333}) respectively. Interaction effect was found significant, among interaction P_2T_2 (20% pruning + 2.5 ml pp^{333}) had recorded minimum (50.41) and interaction P_1T_1 (10% pruning + 2 ml pp^{333}) had recorded maximum (75.48) fruit drop at maturity stage.

Fruit retention at maturity stage was significantly influenced by density pruning and paclobutrazol dose. Maximum fruit retention was recorded (41.41), (43.31) in P2 (20% pruning), T_3 (3 ml pp^{333}) respectively and minimum (36.32), (29.70) in P_3 (30% pruning), T_1 (2 ml pp^{333}) respectively. Interaction effect was found significant, among interaction P_2T_2 (20% pruning + 2.5 ml pp^{333}) had recorded maximum (49.59) and interaction P_1T_1 (10% pruning + 2 ml pp^{333}) had recorded minimum (24.52) fruit retention at maturity stage.

Significantly maximum number of fruits per plant were recorded in P_1 (10% pruning) (109.08), T_3 (3 ml of pp^{333}) (104.68) and among interaction P_1T_3 (10% pruning + 3 ml of pp^{333}) (122.67) has found highest number of fruits per plant. While minimum number of fruits per plant were recorded in P_3 (30% pruning) (69.86), T_1 (2 ml of pp^{333}) (75.15) and among interaction P_3T_1 (30% pruning + 2 ml of pp^{333}) has found least number of fruits per plant (63.51).

Significantly maximum plant yield (kg/plant) were recorded in P_1 (10% pruning) (23.00), T_3 (3 ml of pp^{333}) (21.09) and among interaction P_1T_2 (10% pruning + 2.5 ml of pp^{333}) (24.10) has found highest number of fruits per plant. While minimum number of fruits per plant were recorded in P_3 (30% pruning) (15.70), T_1 (2 ml of pp^{333}) (17.73) and among interaction P_3T_2 (30% pruning + 2.5 ml of pp^{333}) has found least number of fruits per plant (15.32).

Significantly maximum plant yield (t/ha) were recorded in P_1 (10% pruning) (11.49), T_3 (3 ml of pp^{333}) (10.54) and among interaction P_1T_2 (10% pruning + 2.5 ml of pp^{333}) (12.05) has found highest number of fruits per plant. While minimum number of fruits per plant were recorded in P_3 (30% pruning) (7.85), T_1 (2 ml of pp^{333}) (8.86) and among interaction P_3T_2 (30% pruning + 2.5 ml of pp^{333}) has found least number of fruits per plant (7.66).



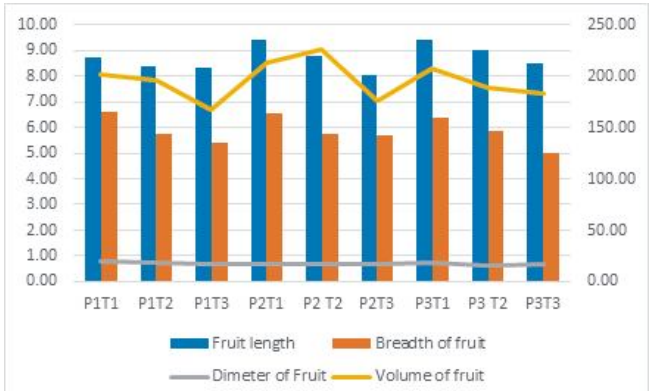
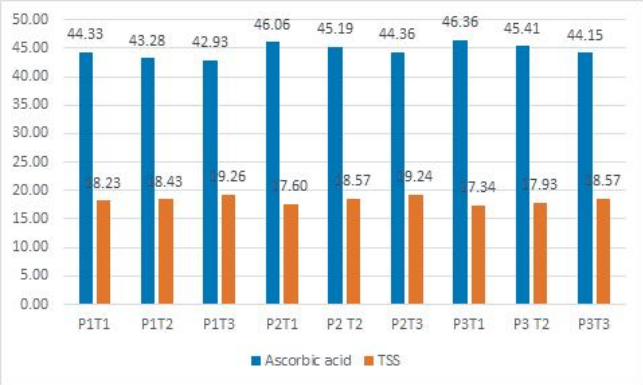


Fig. 1 : Effect of density pruning and paclobutrazol dose on Fruits/plant, Plant Yield, fruit length, Breadth of fruit, Diameter of fruit and volume of fruit.

Table 1 : Effect of density pruning and paclobutrazol dose on fruit drop per cent, fruit retention per cent, no. of fruits/plant, plant yield (kg/plant) and (ton/ha).

Treatments	Fruit drop (%) at different stages			Fruit Retention (%) at different stages			Fruits/plant	Plant yield (kg/plant)	Plant yield (ton/ha)
	Pea stage	Marble	Maturity	Pea	Marble	Maturity			
Factor A: Density pruning (P)									
P_1	78.73*(62.54)	55.50 (48.16)	62.98 *(52.52)	21.27*(27.46)	44.50 (41.84)	37.02 (37.48)	109.08	23.00	11.49
P_2	78.95 (62.69)	65.60 (54.09)	58.59 (49.95)	21.05 (27.31)	34.40 (35.91)	41.41 (40.05)	85.93	19.24	9.62
P_3	79.35 (62.98)	66.90 (54.88)	63.68 (52.94)	20.65 (27.02)	33.10 (35.12)	36.32 (37.06)	69.86	15.70	7.85
SE m±	**0.17**	**0.18**	**0.17**	**0.17**	**0.18**	**0.17**	**0.59**	**0.37**	**0.18**
CD at 5%	**NS**	**0.53**	**0.52**	**NS**	**0.53**	**0.52**	**1.77**	**1.11**	**0.55**
Factor B: Paclobutrazol dose (T)									
T_1	78.92 (62.67)	61.06 (51.39)	70.30 (56.98)	21.08 (27.33)	38.94 (38.61)	29.70 (33.02)	75.15	17.73	8.86
T_2	79.39 (63.00)	65.42 (53.98)	58.27 (49.76)	20.61 (27.00)	34.58 (36.02)	41.73 (40.24)	85.04	19.13	9.56
T_3	78.72 (62.53)	61.52 (51.66)	56.69 (48.84)	21.28 (27.47)	38.48 (38.34)	43.31 (41.16)	104.68	21.09	10.54
SE m±	**0.17**	**0.18**	**0.17**	**0.17**	**0.18**	**0.17**	**0.59**	**0.37**	**0.18**
CD at 5%	**0.50**	**0.53**	**0.52**	**0.50**	**0.53**	**0.52**	**1.77**	**1.11**	**0.55**
Interaction A×B: Density pruning × Paclobutrazol dose (P×T)									
P_1T_1	79.37 (62.98)	50.90 (45.52)	75.48 (60.32)	20.63 (27.02)	49.10(44.48)	24.52 (29.68)	20.89	10.42	20.89
P_1T_2	78.90 (62.66)	57.85 (49.52)	60.11 (50.83)	21.10 (27.34)	42.15 (40.48)	39.89 (39.17)	24.10	12.05	24.10
P_1T_3	77.92 (61.97)	57.76 (49.47)	53.36 (46.92)	22.08 (28.03)	42.24 (40.53)	46.64 (43.08)	24.01	12.00	24.01
P_2T_1	78.68 (62.50)	61.01 (51.36)	66.15 (54.42)	21.32 (27.50)	38.99 (38.64)	33.85 (35.58)	15.98	7.99	15.98
P_2T_2	79.53 (63.10)	73.55 (59.05)	50.41 (45.23)	20.47 (26.90)	26.45 (30.95)	49.59 (44.77)	17.95	8.98	17.95
P_2T_3	78.65 (62.48)	62.24 (52.08)	59.22 (50.31)	21.35 (27.52)	37.76 (37.92)	40.78 (39.69)	23.80	11.90	23.80
P_3T_1	78.73 (62.54)	71.28 (57.59)	69.29 (56.34)	21.27 (27.46)	28.72 (32.41)	30.71 (33,66)	16.32	8.16	16.32
P_3T_2	79.74 (63.25)	64.87 (53.65)	64.27 (53.29)	20.26 (26.75)	35.13 (36.35)	35.73 (36.71)	15.32	7.66	15.32
P_3T_3	79.60 (63.15)	64.57 (53.47)	57.49 (49.31)	20.40 (26.85)	35.43 (36.53)	42.51 (40.69)	15.47	7.73	15.47
SE m±	**0.29**	**0.31**	**0.30**	**0.29**	**0.31**	**0.30**	**0.64**	**0.32**	**0.64**
CD at 5%	**0.87**	**0.92**	**0.90**	**0.87**	**0.92**	**0.90**	**1.92**	**0.96**	**1.92**

*****Value presented in parenthesis indicate the arc sine value.



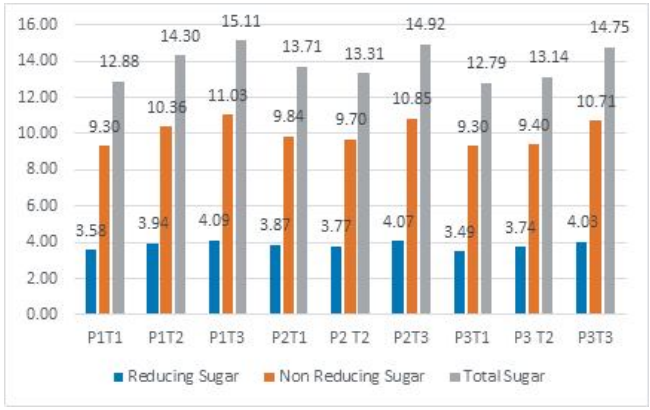


Fig. 2 : Effect of density pruning and paclobutrazol dose on Ascorbic acid, TSS, Reducing sugar, Non Reducing sugar and Total sugar.

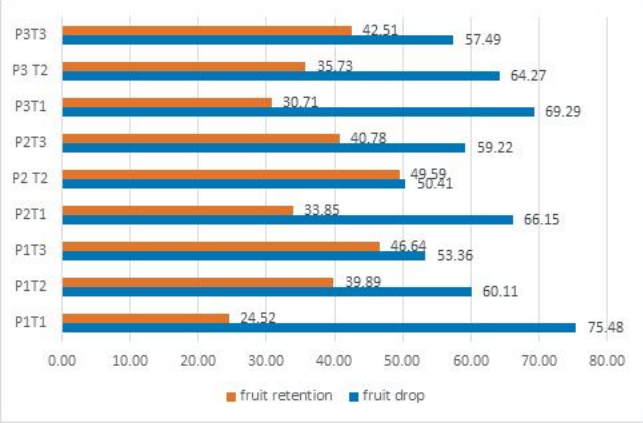


Fig. 3 : Effect of density pruning and paclobutrazol dose on fruit retention and fruit drop.

Pruning leads to increase photosynthesis and utilization of solar light, resulting in higher yield per hectare. The above results are in agreement with findings reported by Pratap *et al.* (2009) in mango, Ali *et al.* (2014) in guava, Adhikari and Kandle (2015), Ghavale *et al.* (2016) in mango and Ansari *et al.* (2018) in mango cv. Amrapali. While paclobutrazol stimulate flowering and fruiting, increase in number of fruits per tree was earlier reported by Golla *et al.* (2017) in mango cv. Banganpalli. The interaction between pruning and paclobutrazol application can significantly enhance plant yield by optimizing both growth management and resource distribution. Pruning reduces excess vegetative growth and improves light penetration and air circulation, allowing the plant to focus its energy on the remaining productive branches and fruits. Paclobutrazol, a growth regulator, further supports this by inhibiting gibberellin synthesis, which helps control excessive shoot growth and strengthens fruit set.

Quality parameters

Observation regarding physical quality i.e fruit weight (unripe/ripe), physiological loses of fruit weight, fruit length, breadth, diameter and volume of fruit, chemical quality i.e reducing sugar, non-reducing sugar, total sugar, ascorbic acid and TSS were calculated and represented in Table 2.

Significantly maximum unripe fruit weight (228.37), (229.90), (246.96) and maximum ripe fruit weight (202.85), (205.24), (219.08) was recorded in P_2 (20% pruning), T_1 (2 ml pp^{333}) and P_2T_2 (20% pruning + 2.5 ml pp^{333}) respectively. While, minimum unripe fruit weight (212.08), (202.38), (195.82) and minimum ripe fruit weight (186.95), (176.60), (168.47) was recorded in P_1 (10% pruning), T_3 (3 ml pp^{333}) and P_1T_3 (10% pruning + 3 ml pp^{333}), respectively.

Physiological losses of fruit weight were recorded non-significantly influenced by density pruning, but significant for paclobutrazol dose and interaction between density pruning and paclobutrazol dose. Maximum PLW was recorded (12.86) and (13.97) in T_3 (3 ml pp^{333}) and P_1T_3 (10% pruning + 3 ml of pp^{333}) respectively. While, minimum PLW was recorded (10.71) and (10.52) in T_1 (2 ml pp^{333}) and P_1T_1 (10% pruning + 2 ml pp^{333}), respectively.

This might be due to the higher availability of photosynthates and to better transportation and accumulation of carbohydrate and other minerals from source to sink, thus improved the fruit weight, this was also finging of Asery *et al.* (2013) in mango cv. Amrapali, Ali *et al.* (2014) and Adhikari and Kandel (2015) in guava. Increase in fruit weight which might be due to diversion of more translocate to the remaining fruits there by increasing the fruit weight in mango. The increase in fruit weight and width may be attributed to the fact that paclobutrazol spray reduced the vegetative growth (sinks) which, in turn, increased the partitioning of nutrients and dry matter towards fruits and there by enhanced fruit size and fruit weight. Maximum individual fruit weight was also recorded by Manohar *et al.* (2023).

Table 2 : Effect of density pruning and paclobutrazol dose on quality parameters of fruit.

Treatments	Unripe fruit weight(g)	Ripe fruit weight (g)	Physiolo-gical losses of fruit weight (%)	Length of fruit (cm)	Breadth of fruit (cm)	Diameter of fruit (cm)	Volume of fruit (cc)	Reducing sugar (%)	Non-reducing sugar (%)	Total sugar (%)	Ascorbic acid (mg/100g)	TSS (°Brix)
Factor A: Density pruning (P)												
P_1	212.08	186.95	11.89*(20.17)	8.45	5.93	18.21	188.15	3.87	10.23	14.10	43.51	18.64
P_2	228.37	202.85	11.18 (19.53)	8.75	5.99	17.27	204.96	3.90	10.13	13.98	45.20	18.47
P_3	218.59	192.91	11.89 (20.17)	8.98	5.74	16.94	192.89	3.75	9.80	13.56	45.30	17.95
SE m±	**2.01**	**1.89**	**0.22**	**0.06**	**0.05**	**0.06**	**2.07**	**0.01**	**0.01**	**0.04**	**0.14**	**0.06**
CD at 5%	**6.01**	**5.68**	**NS**	**0.18**	**0.15**	**0.19**	**6.20**	**0.03**	**0.04**	**0.11**	**0.42**	**0.18**
Factor B: Paclobutrazol dose (T)												
T_1	229.90	205.24	10.71 (19.10)	9.17	6.49	18.36	207.41	3.64	9.48	13.13	45.58	17.72
T_2	226.76	200.87	11.38 (19.71)	8.73	5.80	17.25	203.30	3.81	9.82	13.58	44.62	18.31
T_3	202.38	176.60	12.86 (21.02)	8.29	5.37	16.81	175.29	4.06	10.86	14.93	43.81	19.02
SE m±	**2.01**	**1.89**	**0.22**	**0.06**	**0.05**	**0.06**	**2.07**	**0.01**	**0.01**	**0.04**	**0.14**	**0.06**
CD at 5%	**6.01**	**5.68**	**0.66**	**0.18**	**0.15**	**0.19**	**6.20**	**0.03**	**0.04**	**0.11**	**0.42**	**0.18**
Interaction A×B: Density pruning × Paclobutrazol dose (P×T)												
P_1T_1	222.89	199.43	10.52 (18.93)	8.71	6.58	19.45	202.21	3.58	9.30	12.88	44.33	18.23
P_1T_2	217.53	192.95	11.18 (19.53)	8.36	5.77	18.30	195.30	3.94	10.36	14.30	43.28	18.43
P_1T_3	195.82	168.47	13.97 (21.95)	8.30	5.43	16.88	166.95	4.09	11.03	15.11	42.93	19.26
P_2T_1	234.61	209.26	10.79 (19.17)	9.40	6.54	17.71	212.38	3.87	9.84	13.71	46.06	17.60
P_2T_2	246.96	219.08	11.28 (19.62)	8.81	5.77	17.31	226.45	3.77	9.70	13.31	45.19	18.57
P_2T_3	203.55	180.22	11.47 (19.80)	8.05	5.66	16.79	176.04	4.07	10.85	14.92	44.36	19.24
P_3T_1	232.20	207.04	10.83 (19.21)	9.41	6.35	17.92	207.65	3.49	9.30	12.79	46.36	17.34
P_3T_2	215.79	190.58	11.67 (19.98)	9.03	5.85	16.14	188.14	3.74	9.40	13.14	45.41	17.93
P_3T_3	207.79	181.11	13.16 (21.27)	8.51	5.02	16.75	182.88	4.03	10.71	14.75	44.15	18.57
SE m±	**3.47**	**3.28**	**0.38**	**0.10**	**0.09**	**0.11**	**3.58**	**0.02**	**0.03**	**0.06**	**0.24**	**0.11**
CD at 5%	**10.41**	**9.83**	**1.15**	**0.30**	**0.26**	**0.33**	**10.75**	**0.06**	**0.08**	**0.19**	**NS**	**0.32**

***Value presented in parenthesis indicate the arc sine value.

Plate 1 : Physiological loss in weight (%).

Improvement in fruit quality by optimizing plant growth and resource allocation. Pruning enhances light exposure and air circulation around the fruit, which can lead to better fruit set and reduced disease pressure. Paclobutrazol, growth regulator slows down excessive vegetative growth and promotes a more balanced allocation of nutrients towards fruit development. When used together, pruning and paclobutrazol can synergistically improve fruit quality by reducing the incidence of overgrowth, promoting uniform fruit size and potentially enhancing flavour and texture. Singh *et al.* (2017) reported annual pruning of trees along with paclobutrazol application maintains the fruit quality.

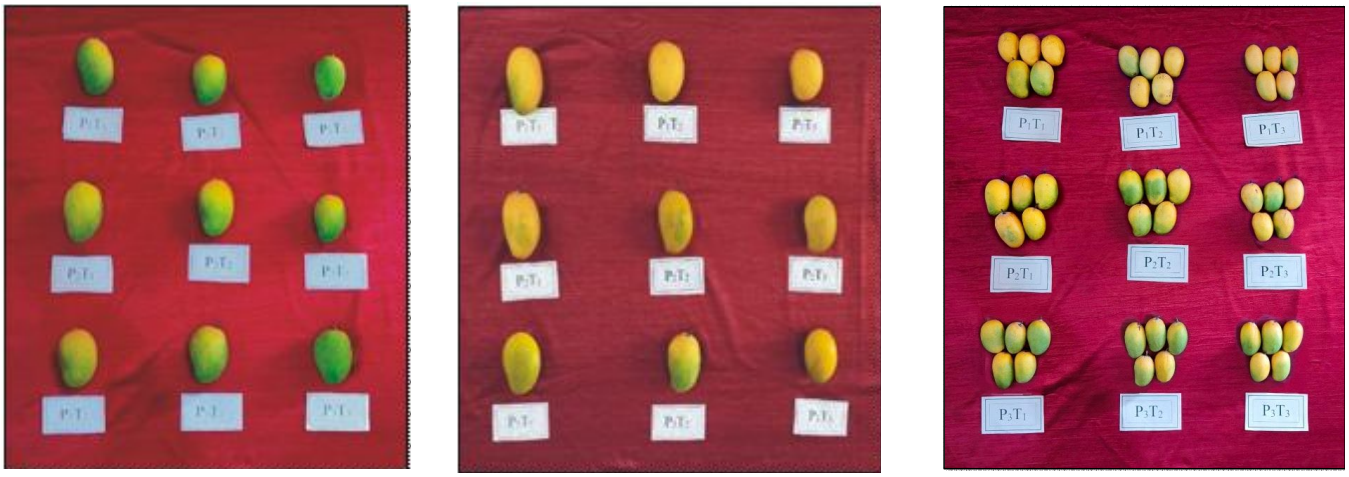


Plate 2 : Variation in harvested fruits due to pruning and paclobutrazol treatments.

Significantly maximum length of fruit (8.98), (9.17) and (9.41) was recorded in P_3 (30% pruning), T_1 (2 ml pp^{333}) and P_3T_1 (30% pruning + 2 ml pp^{333}) respectively, breadth of fruit (5.99), (6.49) and (6.58) was recorded in P_2 (20% pruning), T_1 (2 ml pp^{333}) and P_1T_1 (10% pruning + 2 ml pp^{333}) respectively, diameter of fruit (18.21), (18.36) and (19.45) was recorded in P_1 (10% pruning), T_1 (2 ml pp^{333}) and P_1T_1 (10% pruning + 2 ml pp^{333}) respectively, volume of fruit (204.96), (207.41) and (226.45) was recorded in P_2 (20% pruning), T_1 (2 ml pp^{333}) and P_2T_2 (20% pruning + 2.5 ml pp^{333}) respectively. While, minimum length of fruit (8.45), (8.29) and (8.05) was recorded in P_1 (10% pruning), T_3 (3 ml pp^{333}) and P_2T_3 (20% pruning + 3 ml pp^{333}) respectively, breadth of fruit (5.74), (5.37) and (5.02) was recorded in P_3 (30% pruning), T_3 (3ml pp^{333}) and P_3T_3 (30% pruning + 3 ml pp^{333}) respectively, diameter of fruit (16.94), (16.81) and (16.14) was recorded in P_3 (30% pruning), T_3 (3 ml pp^{333}) and P_3T_2 (30% pruning + 2.5 ml pp^{333}) respectively, volume of fruit (188.15), (175.29) and (166.95) was recorded in P_1 (10% pruning), T_3 (3 ml pp^{333}) and P_1T_3 (10% pruning + 3 ml pp^{333}), respectively.

Significantly maximum reducing sugar (3.90), (4.06) and (4.09) was recorded in P_1 (10% pruning), T_3 (3 ml pp^{333}) and P_1T_3 (10% pruning + 3 ml pp^{333}) respectively, non-reducing sugar (10.23), (10.86) and (11.03) was recorded in P_1 (10% pruning), T_2 (2.5 ml pp^{333}) and P_1T_3 (10% pruning + 3 ml pp^{333}) respectively, total sugar (14.10), (14.93) and (15.11) was recorded in P_1 (10% pruning), T_3 (3 ml pp^{333}) and P_1T_3 (10% pruning +3 ml pp^{333}), respectively. While, minimum reducing sugar (3.75), (3.64) and (3.49) was recorded in P_3 (30% pruning), T_1 (2 ml pp^{333}) and P_3T_1 (30% pruning + 2 ml pp^{333}) respectively, non-reducing sugar (9.80), (9.48) and (9.30) was recorded in P_3 (30% pruning), T_1 (2 ml pp^{333}) and P_1T_1 (10% pruning + 2.5 ml pp^{333}) respectively, total sugar (13.56), (13.13) and (12.79) was recorded in P_3 (30% pruning), T_1 (2 ml pp^{333}) and P_3T_1 (30% pruning +2 ml pp^{333}), respectively.

Light to moderate pruning typically enhances sugar content by reducing the number of fruit-bearing branches, which allows the plant to concentrate nutrients and energy on fewer fruits. Similarly, moderate doses of paclobutrazol improve sugar levels by limiting excessive vegetative growth and redirecting resources to fruit

development similar result was also finding of Reddy *et al.* (2014) in Totapuri and Chaudhari (2017) in mango cv. Sonpari. When both practices are optimized—moderate pruning alongside appropriate paclobutrazol application they can synergistically increase total sugar content by enhancing resource allocation to the fruit.

Significantly maximum ascorbic acid (43.51), (45.58) and TSS of fruit (18.64), (19.02), was recorded in P_1 (10% pruning) and T_1 (2 ml pp^{333}) respectively. While, minimum ascorbic acid (45.20), (43.81) was recorded in P_2 (20% pruning) and T_3 (3 ml pp^{333}) respectively and minimum TSS of fruit (17.95), (17.72) was recorded in P_3 (30% pruning) and T_3 (3 ml pp^{333}) respectively. Ascorbic acid was non-significantly influenced by interaction of density pruning and paclobutrazol dose but TSS of fruit was significantly influenced by interaction of density pruning and paclobutrazol dose. Maximum (19.26) was recorded in P_1T_3 (10% pruning + 3 ml pp^{333}) and minimum (17.34) was recorded in P_3T_1 (10% pruning + 3 ml pp^{333}).

Pruning levels significantly influence the ascorbic acid (vitamin C) content in mango fruit. Generally, moderate pruning enhances fruit quality by improving light penetration and air circulation, which can increase the fruit's ascorbic acid levels due to better nutrient availability and reduced disease incidence. Moderate doses of paclobutrazol can enhance ascorbic acid levels by promoting better fruit development and reducing excessive vegetative growth, which directs more resources towards fruit quality, Similar result was also reported by Kumar *et al.* (2019) in mango cv. Alphonso. Vijayalakshmi and Srinivasan (2000) reported that paclobutrazol in Alphonso mangoes in India had the greatest effect enhancing all the qualitative parameters (ascorbic acid, total sugar, reducing sugar and TSS, except for acidity) in harvested fruits.

Conclusion

In view of the findings and results presented above, it may be concluded that the treatment P_1 (10% pruning) and T_3 (3 ml pp^{333}) found significantly superior over all other treatment. Among interaction effect treatment combination P_1T_3 (10% pruning + 3 ml of pp^{333}) has recorded highest fruit yield and superior quality parameters which was at par with the treatment combination P_1T_2 (10% pruning + 2.5 ml of pp^{333}) in case of fruit yield.

Conflict of interest

The authors declare no conflicts of interest. They bear sole responsibility for the content and composition of the paper.

References

Adhikari, S. and Kandle T.P. (2015). Effect of time and level of pruning on vegetative growth, flowering, yield and quality of guava (*Psidium guajava* L.). *Int. J. Fruit Sci.*, **15**, 290-301.

Ali, F. and Abdel-Hameed A.A. (2014). Effect of pruning on yield and fruit quality of guava trees. *J. Agricult. Vet. Sci*., **7(12)**, 41-44.

Anonymous (2023-24). Agricultural and Processed Food Products Export Development Authority (APEDA).

Ansari, A.M., Ekhlaque A., Bhagat B.K. and Singh D.N. (2018). Effect of planting space and pruning intensity in mango (*Mangifera indica* L.) cv. Amrapali. *J. Pharmacog. Phytochem*., 198-201.

Asery, R., Patel B.V., Barman K. and Pal K.R. (2013). Pruning affects fruit yield and post-harvest quality in mango (*Mangifera indica* L.) cv. Amrapali. *EDP Sci*., **68(5)**, 367-380.

Bompard, J.M. (2009). Taxonomy and Systematics. In: *The Mango: Botany, Production and Uses*. pp. 19-41. Litz, R. E., Ed., CAB International Wallingford, UK.

Burondkar, M.M. and Gunjate R.T. (1991). Regulation of shoot growth and flowering habit in Alphonso mango with paclobutrazol. *Acta Hort.*, **291**, 79-84.

Ghavale, S.L., Pujari K.H. and Patil R.S. (2016). Studies on the effect of pruning on flowering behaviour of Mango cv. Alphonso. *Nat. Acad. Agricult. Sci*. (*NAAS*), **34(4)**, 991-996.

Golla, V.K., Bhagwa A., rajkumar M. and Shiva S. (2017). Flowering and production improvement studies of mango cv. Banganpalli in relation to plant growth regulators and chemicals. *Int. J. Curr. Microbiol. Appl. Sci.*, **6(8)**, 481- 493.

Kumar, K., Gora G.S. and Singh C.P. (2019). Bioefficacy of paclobutrazol on growth, flowering, fruiting and yield attributes of mango cv. Dashehari under Pantnagar agro-climatic condition. *J. Agricult. Ecol. Res. Int.*, **7**, 27-37.

Lebaka, V.R., Wee Y.J., Ye W. and Korivi M. (2021). Nutritional composition and bioactive compounds in three different parts of mango fruit. *Int. J. Environ. Res. Publ. Hlth*., **18(2)**, 741.

Lane, J.H. and Eynon L. (1923). Sugars. In: *Handbook of Analysis and Quality Control for Fruit and Vegetable Products*. Ed. Ranganna, S. Tata Mc Graw Hill Publishing Company, New Delhi.

Manohar, A., Bhaskar J. and Suma A. (2023). Shoot tip pruning and paclobutrazol soil drench on the yield of mango hybrid Ratna under HDP system. *J. Tropical Agricult.*, **61(1)**, 140-142.

Panse, V.G. and Sukhatme P.V. (1985). *Statistical Methods for Agricultural Workers*. ICAR, New Delhi.

Pratap, B., Singh S.K., Singh H.K., Gurav S.S. and Bala S. (2009). Effect of pruning on physio-chemical properties of mango cv. Amrapali under high-density orcharding.

Annals of Horticulture, **2(01)**, 62-64.

Ranganna, S. (1986). *Handbook of Analysis and Quality Control for Fruit and Vegetable Products*. McGraw-Hill Book Company, New Delhi.

Reddy, Y.T.N., Upreti K.K. and Prasad S.R. (2014). Response of paclobutrazol treatment on flowering, fruit maturity, yield and quality of mango (*Mangifera indica* L.) cv. Totapuri. *Indian J. Agricult. Sci.*, **84(10)**, 1231- 1235.

Shah, K.A., Patel M.B., Patel R.J. and Parmar P.K. (2010). *Mangifera indica* (mango). *Pharmacog. Rev*., **4(7)**, 42.

Vijayalakshmi, D. and Srinivasan P.S. (2000). Improving the quality attributes of 'off' year Alphonso mango through chemicals and growth regulators. *Orissa J. Horticut*., **28(1)**, 31-33.

Yadav, A.S. and Pandey D.C. (2016). Geographical perspectives of mango production in India. *Imperial J. Interdisc. Res*., **2(4)**, 257-265.

Yadav, D. and Singh S.P. (2017). Mango: History origin and distribution. *J. Pharmacog. Phytochem*., **6(6)**, 1257-1262.